

What is claimed is:

1           1.    A pressure sensing device comprising:  
2           a substrate having a fluorescent region;  
3           a shell having an outer surface and an inner  
4 surface;  
5           a beam affixed to the inner surface of the shell by  
6 two posts;  
7           a first light transporter having a distal end and an  
8 end proximate the outer surface of the shell in an area  
9 adjacent the beam and the fluorescent region; and  
10          a second light transporter having a distal end and  
11 an end proximate the outer surface of the shell in an area  
12 adjacent the beam and the fluorescent region.

1           2.    The device of claim 1, further comprising a  
2 sensor circuit in communication with the distal end of the  
3 second light transporter.

1           3.    The device of claim 1, wherein the substrate  
2 includes a photodiode illuminated by light from the first  
3 light transporter to excite the beam into vibration.

1           4.    The device of claim 1, wherein the shell and  
2 the beam are at least partially light transmissive so that  
3 light from the first light transporter reaches the photodiode.

1           5.    The device of claim 1, wherein the fluorescent  
2    region is responsive to a first light wave of a first  
3    wavelength from the first light transporter to generate a  
4    second light wave having a second wavelength, and wherein the  
5    second light wave is transmitted by the second light  
6    transporter.

1           6.    The device of claim 1, wherein the substrate  
2    includes a photodiode illuminated by a first light wave of a  
3    first wavelength from the first light transporter to excite  
4    the beam into vibration, wherein the fluorescent region is  
5    responsive to the first light wave to generate a second light  
6    wave having a second wavelength, and wherein the second light  
7    wave has a property dependent upon a frequency of vibration of  
8    the beam and is transmitted by the second light transporter.

1           7.    The device of claim 1, wherein the fluorescent  
2    region comprises erbium.

1           8.    The device of claim 7, wherein the fluorescent  
2    region is illuminated by a light signal from the first light  
3    transporter having a wavelength of 900 nm.

1           9.    The device of claim 1, wherein the shell  
2    defines an evacuated cavity enclosing the beam and the

3 fluorescent region.

1 10. The device of claim 1, wherein the beam is  
2 excited to resonance based upon a photodiode.

1 11. The device of claim 1, wherein the substrate  
2 supports the shell and the beam.

1 12. The device of claim 1, wherein the shell, the  
2 beam and the substrate are micromachined.

1 13. The device of claim 1, wherein the device is  
2 used to sense pressure within an organism.

1 14. The device of claim 1, wherein the first and  
2 second light transporters are optical fibers.

1 15. The device of claim 1, wherein the first and  
2 second light transporters are optical waveguides.

1 16. A method for sensing pressure using a vacuum  
2 cavity device having at least one fluorescent region and a  
3 pressure sensitive resonant beam, the method comprising:

4 directing a first light wave toward the  
5 pressure sensitive resonant beam and the fluorescent region;  
6 exciting the pressure sensitive resonant beam to a

7 resonant frequency in response to the first light wave; and  
8 transmitting away from the pressure sensitive  
9 resonant beam a second light wave generated by the fluorescent  
10 region in response to the first light wave, the first and  
11 second light waves having different wavelengths, the second  
12 light wave having a property corresponding to the resonant  
13 frequency of the pressure sensitive resonant beam.

17. The method of claim 16, further comprising  
evaluating the second light wave in a sensor circuit.

18. The method of claim 16, wherein the exciting  
of the pressure sensitive resonant beam comprises directing  
the first light wave to a photodiode mounted proximate to the  
pressure sensitive resonant beam.

19. The method of claim 16, wherein the  
fluorescent region comprises erbium.

20. The method of claim 16, wherein the first  
light wave has a wavelength of 900 nm.

21. The method of claim 16, wherein the shell, the  
pressure sensitive resonant beam and the substrate are  
micromachined.

1           22. The method of claim 21, further comprising  
2     measuring pressure in a region of the human body as a function  
3     of the second light wave.

1           23. An optically powered integrated microstructure  
2     remote pressure sensor comprising:

3           a substrate supporting a polysilicon shell having an  
4     outer surface and an inner surface, the inner surface defining  
5     an evacuated cavity enclosing an area of the substrate, the  
6     substrate being provided with a fluorescent region;

7           a microbeam affixed to the inner surface of the  
8     shell within the evacuated cavity by two spaced apart posts,  
9     the microbeam disposed in the vicinity of the substrate;

10          a photodiode integrated into the substrate at a  
11     surface location beneath the microbeam;

12          a first light transporter having a distal end and a  
13     proximate end, the proximate end of the first optical fiber  
14     being disposed adjacent the outer surface of the shell to  
15     direct light from the first optical fiber to the photodiode  
16     and to the fluorescent region; and

17          a second light transporter having a distal end and a  
18     proximate end, the proximate end of the second light  
19     transporter being disposed at the outer surface of the shell  
20     so as to transmit light emitted by the fluorescent region,  
21     wherein the transmitted light indicates a frequency of  
22     vibration of the beam.

1           24.    The sensor of claim 23, further comprising  
2    sensor electronics receiving, through the distal end of the  
3    second light transporter, the light wave generated by the  
4    fluorescent region.

1           25.    The sensor of claim 23, wherein the light  
2    received by fluorescent region from the first light  
3    transporter has a wavelength of 900 nm.

1           26.    The sensor of claim 23, wherein the microbeam  
2    is excited to resonance by the photodiode.

1           27.    The sensor of claim 23, wherein excitation of  
2    the microbeam comprises directing the first light wave onto  
3    the photodiode.

1           28.    The sensor of claim 23, wherein the shell, the  
2    microbeam and the substrate are micromachined.

1           29.    The sensor of claim 23, wherein the sensor  
2    measures pressure within the human body.

1           30.    The sensor of claim 23, wherein the first and  
2    second light transporters are optical fibers.

1           31.     The sensor of claim 23, wherein the first and  
2     second light transporters are optical waveguides.

1           32.     A pressure sensing device comprising:  
2             a substrate having a photodiode and a fluorescent  
3     region;  
4             a shell having an outer surface and an inner  
5     surface;  
6             a beam affixed to the inner surface of the shell by  
7     two posts; and  
8             a light transporter having a distal end and an end  
9     proximate the outer surface of the shell in an area adjacent  
10    the beam and the fluorescent region.

1           33.     The device of claim 32, wherein the  
2     fluorescent region comprises erbium.

1           34.     The device of claim 33, wherein the  
2     fluorescent region is illuminated by a light signal having a  
3     wavelength of 900 nm.

1           35.     The device of claim 32, wherein the shell  
2     defines an evacuated cavity enclosing the beam and the  
3     fluorescent region.

1           36.     The device of claim 32, wherein the beam is

2 excited to resonance based upon the photodiode.

1 37. The device of claim 32, wherein the shell, the  
2 microbeam and the substrate are micromachined.

1 38. The device of claim 32, wherein the device is  
2 used to sense pressure within an organism.

1 39. The device of claim 32, wherein the shell and  
2 the beam are at least partially light transmissive so that  
3 light from the light transporter reaches the photodiode.

1 40. The device of claim 32, wherein the light  
2 transporter is an optical fiber.

1 41. The device of claim 32, wherein the light  
2 transporter is an optical waveguide.

1 42. A pressure sensing device comprising:  
2 a substrate having a photodiode and a fluorescent  
3 region;  
4 a shell having an outer surface and an inner  
5 surface; and  
6 a beam affixed to the inner surface of the shell by  
7 two posts.



1           43.    The device of claim 42, wherein the photodiode  
2    is illuminated by a light to excite the beam into vibration.

1           44.    The device of claim 42, wherein the shell and  
2    the beam are at least partially light transmissive so the  
3    light reaches the photodiode.

1           45.    The device of claim 42, wherein the  
2    fluorescent region is responsive to a light of a first  
3    wavelength to generate a second light having a second  
4    wavelength, and wherein the second light has a property  
5    dependent upon a frequency of vibration of the beam.

1           46.    The device of claim 42, wherein the  
2    fluorescent region comprises erbium.

1           47.    The device of claim 42, wherein the  
2    fluorescent region is illuminated by a light having a  
3    wavelength of 900 nm.

1           48.    The device of claim 42, wherein the shell  
2    defines an evacuated cavity enclosing the beam and the  
3    fluorescent region, and wherein the substrate supports the  
4    shell and the beam.

1           49.    The device of claim 42, wherein the shell, the

2 beam and the substrate are micromachined.

1 50. The device of claim 42, wherein the device is  
2 used to sense pressure within an organism.

1 51. An optically powered integrated microstructure  
2 remote pressure sensor comprising:

3 a substrate supporting a polysilicon shell having an  
4 outer surface and an inner surface, the inner surface defining  
5 an evacuated cavity enclosing an area of the substrate, the  
6 substrate being provided with a fluorescent region;

7 a microbeam affixed to the inner surface of the  
8 shell within the evacuated cavity by two spaced apart posts,  
9 the microbeam disposed in the vicinity of the substrate;

10 a photodiode integrated into the substrate at a  
11 surface location beneath the microbeam; and

12 a light transporter having a distal end and a  
13 proximate end, the proximate end being disposed adjacent the  
14 outer surface of the shell to direct light to the photodiode  
15 and to the fluorescent region, and to receive a light wave  
16 emitted by the fluorescent region, wherein the transmitted  
17 light indicates a frequency of vibration of the beam.

1 52. The sensor of claim 51, further comprising  
2 sensor electronics receiving, through the distal end of the  
3 light transporter, the light wave emitted by the fluorescent

4 region.

1 53. The sensor of claim 51, wherein the light  
2 directed to the fluorescent region from the light transporter  
3 has a wavelength of 900 nm.

1 54. The sensor of claim 51, wherein the microbeam  
2 is driven to resonance by the photodiode.

1 55. The sensor of claim 51, wherein excitation of  
2 the microbeam comprises directing the light onto the  
3 photodiode.

1 56. The sensor of claim 51, wherein the shell, the  
2 microbeam and the substrate are micromachined.

1 57. The sensor of claim 51, wherein the sensor  
2 measures pressure within the human body.

1 58. The sensor of claim 51, wherein the light  
2 transporter is an optical fiber.

1 59. The sensor of claim 51, wherein the light  
2 transporter is an optical waveguide.